

CONSEQUENCES OF LIMITING STARCHY VEGETABLES IN SCHOOL LUNCHES

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EXECUTIVE SUMMARY

On January 26, 2012, the Food and Nutrition Service, United States Department of Agriculture (USDA) issued final regulations to implement the alignment of the National School Breakfast and School Lunch Programs with Dietary Guidelines for Americans (*Federal Register*, 77, 17, 4088-4167). While the school meal program rules were in review period, the Dietary Guidelines were updated. As a result, USDA modified the proposed school meal regulations to incorporate the new nutritional guidelines, and allowed for public comment upon the additional changes. The proposed rules had included a limitation on starchy vegetables such as potatoes, but the FY 2012 Agriculture Appropriations Act included a provision that prohibited USDA from setting maximum limits on serving starchy vegetables. Although the limitation was removed in the final rules, the summary of comments reveals that questions remain about the effect of excluding starchy vegetables such as potatoes from school meals. In general, questions center on issues concerning costs, student participation in the National School Lunch Program, nutritional values of meals, and overall vegetable intake or plate waste.

This report relates to a pilot study conducted to investigate these issues, funded by the Alliance for Potato Research and Education (APRE). This pilot study deals with selected schools located near Texas A&M University in the Bryan Independent School District (BISD) and selected schools located in the Dallas Independent School District (DISD). These school districts participate in federally-funded school meal program. The DISD in particular is the 14th largest school district in the United States.

The objectives of this pilot project are fourfold: (1) to provide measures of plate waste for entrees and vegetables from school lunches in selected elementary schools in Bryan, TX and Dallas, TX over the period April 2012 to January 2013; (2) to determine the factors which affect plate waste for entrees and vegetables from school lunches; (3) to assess the economic/financial consequences of limiting potatoes and substituting other vegetables in school lunches; (4) to assess the nutritional consequences with a focus on calories, dietary fiber, and potassium of limiting potatoes and substituting other vegetables in school lunches.

Before this study began, the Institutional Review Board (IRB) at Texas A&M University approved the study, as did both district IRBs. Three schools in DISD were matched to three schools in BISD based on percentage eligible for free or reduced-price school meals and comparable numbers of student enrollment. All school principals, teachers, and food service and custodial staff were notified of the study objectives, the dates of collection, and the plate waste study protocol. Teachers explained the protocol to their students before lunch on days of collection and instructed students that they were not obligated to participate. No child refused to participate at any school.

All six sampled schools adopted the offer vs. serve meal concept, in which students are required to take at least three out of five components offered for the meal to qualify as a USDA National

School Lunch Program (NSLP) reimbursable meal. With the new Nutrition Standards for School Meals, beginning with the Fall 2012 academic year, at least one of the three food components chosen must be a half cup serving of fruits or vegetables. The new rule was not in effect when the collection of plate waste data began at BISD schools in Spring 2012.

Phase 1 of the study included ten days of plate waste collections in BISD in April and May 2012, before implementation of the Nutrition Standards for School Meals. During Phase 2, the remaining 20 out of 30 total collection days in BISD occurred in October 2012 and November 2012. During Phase 3, plate waste for all 30 lunchtime meals was collected for DISD in November 2012, December 2012, and January 2013. A total of 60 days of plate waste collection of lunchtime meals were sampled. All lunch periods for both districts were scheduled by grade (K-5) and the amount of time allocation for lunch was 30 minutes among all schools.

In both districts, the same menu was served throughout all lunch periods for kindergarten through fifth grade (K-5) and in BISD, the serving size was identical across grades for the sampled schools. On occasion, the food service staff for DISD served larger serving sizes of some food items to avoid discarding large quantities of food at the end of the final lunch period. To account for this variation, the project team took additional pre-weights of the food items that deviated from the standard serving size (discussed further below). BISD and DISD followed eight-week and two-week menu cycles rotations, respectively.

The respective vegetables on school lunches fall into three categories: (1) potatoes; (2) other starchy vegetables; and (3) non-starchy vegetables. The list of vegetables during the three respective phases of the pilot project is given as:

Bryan ISD Spring Plate Waste Collection (Phase 1)	Bryan ISD Fall Plate Waste Collection^a (Phase 2)	Dallas ISD Plate Waste Collection^a (Phase 3)
Potato Starchy Vegetables		
French Fries	French Fries	French Fries
Mashed potatoes	Mashed potatoes	Mashed potatoes
Potato Wedges	Potato wedges	
Tater Tots	Tater Tots	
Other Starchy Vegetables		
Corn on the Cob 3"	Baked beans	Baked Beans
Green Peas	Corn on the Cob 3"	SW Beans
Ranch Style Beans	Green Peas	Sweet Potatoes
	Pork and beans	Sweet Potato Fries
	Sweet potato fries	Whole kernel corn
	Ranch Style Beans	
	Raw sweet potato sticks (a starchy vegetable)	
	Whole kernel corn	

Bryan ISD Spring Plate Waste Collection (Phase 1)	Bryan ISD Fall Plate Waste Collection ^a (Phase 2)	Dallas ISD Plate Waste Collection ^a (Phase 3)
Non-Starchy Vegetables		
Green beans	Baby carrots and celery sticks (raw)	Asian vegetables
Sandwich trimmings (lettuce, tomato, and/or sliced pickles) ^b Steamed broccoli	Broccoli florets (raw)	Baby carrots
Veggie dippers (raw carrots, celery, and cucumber)	Garden salad (iceberg lettuce, spinach, cabbage and carrots)	Broccoli
	Green beans	Broccoli salad
	Mixed Normandy vegetables (cooked broccoli, cauliflower, carrots)	Glazed carrots
	Sonoma vegetables (cooked sugar snap peas, carrots, yellow carrots, broccoli)	Green beans
	Steamed broccoli	Italian vegetables
	Steamed broccoli w/cheese sauce	Spinach
	Veggie dippers (raw carrots, celery, and cucumber)	Spinach salad
	Whole dill pickle	Tomato and cucumber salad
		Turnip greens

Standard methodologies to measure plate waste from school lunches were utilized. In addition to the determination of plate waste, representative photographs were taken of plate waste for the respective entrée/vegetable combination in the BISD and in the DISD. Plate waste is defined as the quantity of edible portions of food served that students discard. Plate waste has been assessed by a variety of methods and expressed in terms of proportion of food served that is uneaten, amount of calories, uneaten, or amount of nutrients uneaten. Plate waste in school lunches traditionally has been measured using several methods, including physical measurements such as weighing discarded food; visual estimates made by trained observers; recalls made by children (Buzby and Guthrie, 2002), and combinations of methods that include weighing discarded food, photographing and analyzing contents of full and discarded plates (Marlette, Templeton, and Panemangalore, 2005).

The key measure is the percentage of plate waste of the respective entrée and vegetable items. To arrive at this measure, we obtain the total amount of plate waste (in grams) and divide this total by the number of children who had the entrée or vegetable in question. The ratio provides the plate waste per child (in grams). We finally calculate the percentage of plate waste by dividing this ratio by the pre-weight of the entrée or vegetable item, also measure in grams. About 50 undergraduate and graduate field workers, various community volunteers, and project coordinators were involved in the data collection.

Bryan ISD and Dallas ISD provided the following public information: (1) district costs per-item (excluding labor costs); (2) most nutrient profile information per-serving size for all food items on the elementary school lunch calendar; (3) school lunch production sheets for the days of plate waste collection that include the number of servings per-item served; (4) meal counts (free, reduced, paid, and “other” meals served on days of plate waste collection; and (5) historical school lunch information beginning with the 2010-2011 school year (elementary lunch calendar, food costs, and nutrient profile per serving for all foods and beverages served, and free and reduced meal participation.

We provide three separate analyses: (1) BISD Spring (April 2012 and May 2012) known as Phase 1; (2) BISD Fall (October 2012 and November 2012) known as Phase 2; and (3) DISD Fall/Winter (November 2012, December 2012, and January 2013) known as Phase 3. The menus for the BISD Fall period and for the DISD Fall/Winter period are compliant with the new 2012 nutrition standards for school meals, that is, the new USDA rules. Consequently, we are in position to compare empirical results not only across school districts but also across time periods with different nutrition standards for school meals. The analysis for BISD Spring consists of a combined 10 visits to Sam Houston (S), Mary Branch (B), and Anson Jones (J) elementary schools in the months of April 2012 and May 2012. This sample consists of a total of 144 “viable” observations for BISD Spring. The analysis for BISD Fall consists of a combined 20 visits to Sam Houston (S), Mary Branch (B), and Anson Jones (J) elementary schools in the months of October 2012 and November 2012. This sample consists of 308 “viable” observations for BISD Fall. Finally, the analysis for DISD Fall/Winter consists of 10 visits each to George Washington Carver (GWC), Stonewall Jackson (SJ), and Junkins (J). This sample consists of 434 “viable” observations for DISD Fall/Winter.

All of the data collected are related to plate waste, preparation or lunch costs, and nutrition information. We record information as to the particular school, data, grade, the type of entrée, number of students consuming the entrée, type of vegetable, the entrée pre-weight, the vegetable pre-weight, the entrée plate waste in terms of percent, the vegetable plate waste in terms of percent, the total number of students (male and female) who bought/received a school lunch, the total number of lunches served, the number of free lunches served, the number of reduced lunches served, and the number of paid lunches. As per the economics dimension, we also record the cost per serving of each entrée, the number of entrée meals prepared, the cost associated with the preparation of each entrée type, the cost per serving of each vegetable, the number of vegetable meals prepared, and the cost associated with the preparation of each vegetable type, and the total cost associated with preparation of the lunch on that day. As per the nutrition dimension, we record data in regards to calories, dietary fiber, and potassium associated with each entrée type and each vegetable type.

In a report to Congress, Buzby and Guthrie (2002) estimated that food waste costs might approach \$600 million. However, the authors had access to only aggregate school meal costs and were unable to examine costs of waste specific to vegetables and entrees. Our research permits this examination indigenous to vegetable and entrees.

Cohen et al (2013) examined nutrient losses and economic costs associated with school meal waste among middle school students (grades 6-8) in Boston public schools. Analyses were conducted in 2010-2011. Cohen et al (2013) found substantial food waste among middle school students in Boston as well as notable costs associated with discarded foods. For vegetables, Cohen et al (2013) estimated the average cost per vegetable item to be \$0.21, the average percentage waste for vegetables to be 73% and for entrees to be 18%, and the average waste cost per student to be \$0.09 for vegetables and \$0.10 for entrees.

Key points from the three phases of the pilot project are as follows:

- Our sample of observations meets the statistical criterion of representativeness. For example, for Phase 1, we sampled two of every three school lunches, and for Phase 2, we sample one of every two school lunches.
- As measured by the median number of student who select various vegetables, potatoes in various processed forms are the most popular vegetables.
- On average, plate waste for vegetables was greater than plate waste for entrées. A breakdown of the average plate waste for vegetables and entrées across the three phases of the project is as follows:

Phase	Plate Waste for Vegetables	Plate Waste for Entrées
BISD Spring – Phase 1	52.1%	28.6%
BISD Fall – Phase 2	57.6%	29.6%
DISD Fall/Winter – Phase 3	48.5%	33.1%

Our figures for plate waste for vegetables are lower than that estimated by Cohen et al (2013). However our figures for plate waste for entrees are higher than that estimated by Cohen et al (2013).

- Plate waste for vegetables and entrees varies by type of vegetable and by type of entrée.
- Plate waste for potatoes is less than the plate waste for other starchy vegetables and for non-starchy vegetables. Details across the three phases are as follows:

Phase	Plate Waste for Potatoes	Plate Waste for Starchy Vegetables	Plate Waste for Non-Starchy Vegetables
BISD Spring – Phase 1	42.6%	70.8%	52.2%
BISD Fall – Phase 2	39.4%	65.2%	61.4%
DISD Fall/Winter – Phase 3	33.4%	53.6%	51.2%

- Plate waste for potatoes varies by product form.

Phase	Potato Wedges	French Fries	Tater Tots	Mashed Potatoes
BISD Spring – Phase 1	55.3%	36.1%	27.4%	51.5%
BISD Fall – Phase 2	45.3%	41.0%	16.9%	54.5%
DISD Fall/Winter – Phase 3	---	28.4%	---	38.3%

In particular, plate waste for French fries and tater tots are lower in comparison to plate waste for potato wedges and mashed potatoes.

- Plate waste for vegetables varies by school:

Phase	Bryan Independent School District			Dallas Independent School District		
	Mary Branch	Sam Houston	Anson Jones	Stonewall Jackson	George Washington Carver	Junkins
BISD – Phase 1	51.5%	53.8%	51.1%	---	---	---
BISD – Phase 2	56.9%	60.0%	56.7%	---	---	---
DISD – Phase 3	---	---	---	57.5%	49.3%	38.0%

Schools with the lowest percentage of free lunches (Sam Houston and Stonewall Jackson) have the highest percentages of plate waste for vegetables.

- Plate waste for vegetables varies by grade:

Phase	Kindergarten	1 st	2 nd	3 rd	4 th	5 th
BISD – Phase 1	56.5%	51.71%	54.9%	41.1%	48.4%	59.7%
BISD – Phase 2	64.4%	53.3%	57.9%	57.2%	54.0%	59.5%
DISD – Phase 3	49.9%	46.5%	49.6%	50.9%	48.2%	45.0%

- Plate waste for entrees varies by school:

Phase	Bryan Independent School District			Dallas Independent School District		
	Mary Branch	Sam Houston	Anson Jones	Stonewall Jackson	George Washington Carver	Junkins
BISD – Phase 1	26.5%	29.1%	31.5%	---	---	---
BISD – Phase 2	28.8%	31.1%	25.8%	---	---	---
DISD – Phase 3	---	---	---	42.5%	30.4%	25.1%

Schools with the lowest percentage of free lunches (Sam Houston and Stonewall Jackson) have the highest percentages of plate waste for entrees.

- Plate waste for entrees varies by grade:

Phase	Kindergarten	1 st	2 nd	3 rd	4 th	5 th
BISD – Phase 1	37.0%	35.1%	29.9%	29.5%	22.1%	23.2%
BISD – Phase 2	41.9%	29.0%	32.7%	23.6%	22.7%	22.2%
DISD – Phase 3	42.4%	36.0%	40.3%	27.8%	28.9%	24.0%

Plate waste for entrees is lowest for children in the third, fourth, and fifth grades in comparison to children in kindergarten, first, and second grade.

- On the basis of econometric analysis, drivers of plate waste for vegetables include: (1) the percentage of plate waste for entrees (only in BISD Phase 1, but not for BISD Phase 2, or DISD Phase 3); (2) grade (not for BISD Phase 2); (3) school (not for BISD Phase 2); (4) vegetable type; (5) percentage of females buying lunch (not for BISD Phase 2 or DISD Phase 3); and (6) month (not for BISD Phase 2). **The principal driver of plate waste for vegetables is vegetable type.**
- The goodness-of-fit measures (R^2) for the econometric model of plate waste for vegetables were 50 percent, 42 percent, and 38 percent for BISD Phase 1, BISD Phase 2, and DISD Phase 3 respectively. Given that these data correspond to cross-sectional observations, these goodness-of-fit measures are noteworthy.
- On average the cost of vegetables per serving varies across types of vegetables. But, the cost per serving for potatoes is less than the cost per serving for other starchy vegetables and non-starchy vegetables.

Phase	Potatoes	Other Starchy Vegetables	Non-Starchy Vegetables
BISD Spring – Phase 1	\$0.0935	\$0.2128	\$0.1463
BISD Fall – Phase 2	\$0.0867	\$0.1732	\$0.1629

- On average, the lost or wasted dollars per student served of potatoes ranges from 3 cents to 4 cents; for other starchy vegetables, this measure jumps to 16 cents to 21 cents, and for non-starchy vegetables, this measure ranges from 9 cents to 10 cents. Our figures are in accordance with the average waste cost per student calculations provided by Cohen et al (2013) of \$0.09 for all vegetables.
- Differences in the lost or wasted dollars are evident across the respective vegetables. For BISD, Phase 1, the lost dollars per serving of vegetables ranges from \$0.0289 (mashed potatoes) to \$0.1822 (corn on the cob). For BISD Phase 2, the lost dollars per serving of vegetables ranges from \$0.0202 (tater tots) to \$0.2512 (sweet potato fries).
- Because of plate waste, reductions in nutrients (calories, dietary fiber, and potassium) are evident. The percentage of lost calories, dietary fiber, and potassium for vegetables ranges from 17% (tater tots) to 90% (sweet potato fries).
- For BISD Phase 1, the range in the reduction in calories per serving of vegetables is 4 (pickles) to 95 (ranch style beans). For BISD Phase 2, the reduction in calories per serving of vegetables is 5 (pickles) to 163 (sweet potato fries).

In 2010, Congress passed the Healthy Hunger-Free Kids Act with a goal to ensure that children receive nutritious meals at school. Dietitians, nutritionists, and meal planners from the respective elementary schools know what food items the students are choosing, but they do not necessarily know the specific consumption and waste behaviors. This information is central to our research project, and underlines the importance of plate waste data collection. Our research describes not only the vegetables that are wasted the most, but also the nutrients that students are not receiving by choosing not to eat particular vegetables, and of course the implications associated with economic cost. In any research scenario, where it is found that food items are being wasted, particularly those designated as healthy, strategies must be developed and implemented to increase consumption. These strategies may include conducting taste tests, providing nutrition education, and implementing health promotion interventions. Hanks, Just, and Wonsink (2012) introduce the notion of *trigger foods*, defined as, for the purpose of our study, foods that either increase or decrease the selection of various vegetables.

Based on the results from our project, we ascertain the consequences of limiting potatoes and other starchy vegetables on school lunch menus, considering both nutritional and economic dimensions. This information is valuable to policy makers, food service professionals, and perhaps other Federal, State, or local program staff. Importantly, our pilot project has the potential not only to be conducted on a larger scale down the road but also to be implemented at relatively low cost. In essence, our proposed project serves as an initial undertaking designed to vet the merits of the FNS initiative.